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ABSTRACT

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Teaching, Interviewing, and Learning Theory

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Paper presented at the Annual National Science Teachers Association (NSTA) Convention held in Washington, D.C. April 7-11, 1978.

SE 025 317

ABSTRACT

Teaching, Interviewing, and Learning Theory*

The major claim of this paper is that teachers should acquire the skills of administering clinical interviews in order to improve their instruction. First, the concepts of "teaching" and "learning" are differentiated and analyzed. Then certain aspects of theories of teaching and learning are covered. Following that, the conclusion that a theory of learning is necessarily lexically prior to a theory of instruction is drawn. Finally, the Modified Piagetian Clinical Interview (MPCI) is outlined and suggested as a method to probe and assess children's cognitive structures. Thus, the MPCI is offered as one technique which bridges both teaching and learning theories.

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* The paper which follows is a transcript of an actual presentation delivered in the Sheraton Park Hotel in Washington, D.C. on the 10th of April, 1978 at 12:00 - 1:00 pm. Questions and answers were not clearly recorded and thus do not appear in the body of the paper.

Introduction

I will limit my talk to fifteen minutes so as to save sufficient time for questions.

The first portion of the presentation will be, to a large extent, theoretical. The second part of the paper will be more pragmatic. The paper is divided into three different but highly related topics. First I want to clarify the concepts of "teaching" and "learning" which have a long history of confusion. I will at this time say a few things about these concepts and provide some examples so as to clarify their relationship. Then, I want to talk about theories of teaching and theories of learning. Again, an attempt will be made to clarify the relationship of these theories. A justification for the strong claim that theories of learning must necessarily be lexically prior to theories of teaching will be articulated. And, finally, I'd like to concentrate on the interphase between teaching and learning (and between teaching theories and learning theories). Specifically, in this portion of the paper, I will briefly describe a modified version of the Piagetian Clinical Interview (viz. MPCI), a technique used by researchers in evaluating and assessing aspects of cognitive structure, and propose that the expertise necessary to administer such interviews should be acquired by teachers.

The Concepts of "Teaching" and "Learning"

"Teaching" and "learning" are two concepts which are central to a theory of education. These important concepts have been recognized by educators and philosophers and discussed for millena. These educators

have not debated whether "teaching" and "learning" are important in educational theory and practice per se, but rather, they have mainly argued concerning the nature of the relationship between these concepts. Any theory of education should entail at least four key concepts: "teaching", "learning", "curriculum", and "governance". You will find these concepts described in a manuscript by D. Bob Gowin (1976) at Cornell University. I will limit myself to "teaching" and "learning", even though they do not provide for a total theory of education.

"Teaching" refers to the teacher's attempt to impart some form of knowledge to students. "Learning" entails the internalization of information usually resulting in permanent changes in behavior or cognitive structure. What has been the relationship between these two concepts in the past? We find much confusion in the literature and as recently as 1933, John Dewey in his How We Think said the following:

> Teaching may be compared to selling commodities. No one can sell unless someone buys. We should ridicule a merchant who said that he had sold a great many goods although no one had bought any. But perhaps there are teachers who think that they have done a good day's teaching irrespective of what pupils have learned. There is the same exact equation between teaching and learning that there is between selling and buying.
>
> (pp. 35-36)

Clearly there is a problem in tying "teaching" and "learning" together as in the above quotation. We know that learning can occur without any specific teaching; and we know that an excellent teacher can spend a day of teaching without accomplishing the desired learning outcomes. Dewey is saying that as a teacher you should not feel that you have done any teaching after a long day's work, if your students have failed

to learn. I would like to question this notion.

First of all, it should be clearly understood that learning is the student's own responsibility. And, conversely, teaching is not something that you do to people. Teaching is an attempt to reach shared meaning with students. This is not to say that teachers have no responsibility; rather, it means that a teacher can have the best intentions and provide all the necessary conditions for learning and yet still fail to accomplish intended learning outcomes.

How can this relationship between "teaching" and "learning" be reconciled? Recently, educational philosophers such as Israel Scheffler have provided answers. Scheffler has pointed to the fact that teaching and learning must be viewed as different types of activity verbs. "Teaching" is an intention verb; you intend to accomplish something in the classroom or with your students. "Learning" on the other hand is a success verb that is consequent or subsequent to the successful accomplishment of skills or internalization of information.

For example, one can run a race with the intention of winning, yet not win the race. We would not say that one did not run simply because they failed to win. Thus racing and winning are two different types of verbs: "racing" is an intention verb whereas "winning" is a success verb. This is precisely the relationship between "teaching" and "learning" and just as it would be absurd to say that one did not race because one did not win, so too, it would be ridiculous to claim that because learning did not occur, there was no teaching.

These ideas have been well clarified and accepted in the philosophy of education during the last two decades. I must again emphasize that the above does not remove the onus of responsibility for appropriate

teaching from the teacher's shoulders. Rather, it enables one to distinguish, and for the purposes of discussion and analysis, to momentarily tear the concepts of "teaching" and "learning" asunder. Thus the concept of "teaching" and the concept of "learning" can be analyzed separately. An excellent outline of the arguments advanced thus far in this paper together with an analysis of the concept of "teaching" can be found in Tom Greene's (1971) The Activities of Teaching.

Teaching and Learning Theories

Keeping in mind that "teaching" and "learning" are not two sides of the same coin in the sense that selling and buying are, we can now turn our attention to theories of teaching and learning. Many theorists have propounded theories of teaching (or instruction) and theories of learning without ever clarifying the relationship between the key concepts of "teaching" and "learning". However, with a more clear conception of the relationship between "teaching" and "learning", it will be easier to justify a discussion of the relationship between the respective theories of teaching and learning. We shall first concentrate on whether one can have a theory of teaching (or instruction) without having a theory of learning. Then, we will analyze the exact relationship between teaching and learning theories.

Jerome Bruner (1966), for instance, has written a book which has been quite influential in the domain of education: Toward a Theory of Instruction. Such writings imply that it is possible to construct a theory of instruction and to explain how one should go about teaching, without taking into account how learners learn. Such notions are prevalent in behavioristically oriented literature, viz. behavior modifi-

cation. Bruner, of course, is a cognitive psychologist and thus he is less extreme than others. Nevertheless, he typifies a large school of educational thought which places emphasis on instruction independent of learning.

The idea that one can construct a theory of teaching without first having a theory of learning; or that a theory of learning is unnecessary in constructing a theory of instruction; or that a theory of learning will follow from a theory of instruction are all ideas propounded by numerous educational theorists. I will attempt to argue that these ideas are incorrect! The position I argue against is precisely stated by Stiles (1974) in the introduction of a book which he has edited, called Theories of Teaching.

Stiles says the following:

> A few scholars, notably among them Jerome Bruner, have attempted to formulate a theory for teaching (or a theory for nonteaching, as Carl Rodgers has done). Others have argued that teaching and learning are so intertwined that they cannot be studied as separate processes. Such scholars generaly subscribe to the superficial doctrine that 'if learning does not occur, there has been no teaching'. Thus, they claim, the focus should be on learning and not on teaching . . . As research on teaching is undertaken, the need is for refined theory to point the way.
>
> (pp. ix-x)

Obviously, the point made by Stiles that those who propound a theory of learning do so because "teaching and learning are so intertwined that they cannot be studied as separate processes" is incorrect. I have already clarified in the first portion of the paper that "teaching" and "learning" can be separated for purposes of discussion, yet

I still maintain that a theory of learning is necessary before one can construct a theory of teaching. The issue is more profound than Stiles has led us to believe!

Why is a theory of learning necessary prior to a theory of teaching? I would maintain that it is impossible to go about teaching something in an orderly fashion unless you have some idea about how people learn what you intend to teach. Of course, you could by trial and error or through intuition provide excellent instruction and accomplish the desired learning outcomes, but this would not be a theory of instruction. Unless you know how people internalize concepts, how people acquire information, i.e. how learning occurs, it is very difficult to direct your teaching toward these purposes. Furthermore, one cannot articulate a theory of such instruction without prior assumptions concerning the learning process, i.e. how learning occurs.

Another point which may help in clarifying the above is that learning is a natural biological process whereas instruction as it occurs in schools is a cultural and artificial process. In fact, of the four major concepts in education ("teaching", "learning", "curriculum", and "governance"), "learning" is the only biological and natural process - all the rest are artifacts of human civilization and culture. Thus, it follows that one must start from the process of learning and proceed to the other phenomena. An appropriate theory of teaching can result from examining the learning process. That is, once we understand how learning occurs, we can go about constructing a theory and method of instruction that would optimize learning. The opposite is, of course, not possible. I will refer to the fact that an adequate theory of learn-

ing must be prior to an adequate theory of instruction as: a theory of learning is lexically prior to a theory of teaching.

Joseph D. Novak (1977) has written a book called A Theory of Education. And, in this book, Novak advances an argument similar to mine. Novak has the following to say:

> Bruner in Toward a Theory of Instruction (1966) actually puts the cart before the horse and says that 'a theory of instruction, which must be at the heart of educational psychology, is principally concerned with how to arrange environments to optimize learning according to various criteria - to optimize transfer or retrievability of information for example' (pp. 37-38). But it is specifically to the issue of 'how to arrange environments to optimize learning' that useful educational psychological theory (and not instructional theory) should apply.
>
> (p. 136)

In other words we've first got to simply have some idea about what it is we want to teach students, and secondly how they internalize that information before we can start talking about optimizing the environment to accomplish these ends.

Previously I quoted Stiles and now I will continue that same citation:

> This book, written by a team of scholars from various disciplines, aims to show how various kinds of theories can help shape the nature and contributions of teaching . . . Together, they focus the reader's attention on the importance of theories for teaching and illustrate in a variety of ways the differences that given theories can make in the teaching approach and its effectiveness.
>
> (pp. ix-x)

What I would maintain now is that what Stiles has done is to vindicate Novak's contention. For the whole book that Stiles has edited is a series of articles on what different theories have to say to in-

struction: for instance, theories of learning, social theories, and so on and so forth. Thus the name of Stiles' book is indeed a misnomer, and one will necessarily need in any case of teaching theories to have some prior assumptions about learning. Therefore, in order to improve instructional theory we should turn our attention to appropriate theories of learning.

Now I will turn my attention to learning theory. However, it is difficult to summarize a theory of learning in just a few minutes. Thus I will only speak very superficially and pointedly to those aspects of a theory of learning which have relevance for this paper. Most conveniently, David P. Ausubel (1963, 1968, 1978), the learning theorist from whom I draw my ideas, has summarized educational psychology in his following epigraph:

> If I had to reduce all of educational psychology to just one principle, I would say this: The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly.
>
> (1968, p. vi)

This statement, most educational psychologists would agree, is a very, very insightful remark. But now you are left with the task of 'ascertaining what the learner already knows'. As researchers investigating the process of concept acquisition, we find ourselves asking the same question precisely.

We can, of course, very easily administer standardized achievement tests so as to collect normative data, i.e. how child X compares to his/her peers on that test. However, such data tells us very little about what concepts the student has got and how s/he acquired those concepts. Furthermore, we cannot examine conceptual change over time.

To illustrate these problems, let me show you a typical correlation matrix of scores from different types of tests. Notice the numerous significant correlations between these scores - What do they mean? For example, notice the correlation between the Metropolitan Readiness Test administered to children prior to the first grade, and the Stanford Achievement Test administered subsequent to the first grade. The correlation is striking and the one variable accounts for over 70% of the variance of the other variable. Thus we can say that prior knowledge seems to have a profound effect on subsequent achievement.

Place Table 1 about here.

However, what do such correlations tell us about what the child knows, which concepts and misconceptions s/he has acquired, and how s/he goes about solving problems? Indeed, very little useful information can be gleaned from such data either by researchers or by teachers.

The Clinical Interview

In order to ameliorate the deficiencies in the data collected by the previously described tests, we have attempted to use clinical interviews. Clinical interviews have a long history in the domains of abnormal psychology, psychiatry, and in medicine generally. However, in the field of developmental psychology, they have been used predominantly by Jean Piaget. Piaget has single-handedly adopted and modified clinical interviews so as to render them amenable for research into children's construction of intelligence (See Piaget 1929, 1930). At Cornell University, we have modified these interviews in attempt to investigate the

process of concept acquisition. Thus, whereas Piaget's interviews have become more and more standardized and specific for certain tasks, e.g. conservation tasks, our interviews are more flexible and enable us to probe the students' cognitive structures and to find out which conceptions and misconceptions they have acquired. Such interviews have been termed Modified Piagetian Clinical Interviews (See Pines et al., 1978).

The Modified Piagetian Clinical Interview (MPCI)

In this last section of the paper, I will very briefly describe the MPCI and then explain its practicality for teachers. I may add parenthetically that Audry Champaign and Leo Klopfer (1978) in the paper that they presented the day before yesterday stated that very often research tools turn out to be very useful instructional tools. And indeed, I will describe how we as researchers go about conducting interviews but the upshot will be the usefulness of these interviewing skills for most of you as teachers.

The interviewer is guided by the subject matter content which he wishes to investigate. In order to facilitate the administering of the interview, a concept map, depicting the conceptual content of the subject matter, is used. Concept maps are simple semantic networks with concepts as nodes and lines expressing relationships. The ordinate dimension depicts the hierarchical (superordinate - subordinate) relationship between concepts, whereas the abscissa differentiates different content areas. Figure 1 depicts a typical concept map.

Place Figure 1 about here.

In this concept map, I have specifically drawn the contents of

Joseph D. Novak's (1972) Audio-Tutorial Elementary Science Project (A-TESP). I have limited myself to certain aspects of the concepts of "life" (mainly on the left of the map) and "energy" (mainly on the right of the map). Adding additional information would have added unnecessary obfuscating complexity. Thus, for each interview one might construct a simple concept map with the labels expressing the major concepts and the lines expressing the relationships that the interviewer intends to probe. I used this concept map in interviewing children prior and subsequent to A-TESP instruction in order to find out what they knew about the concepts of "life" and "energy" (See Pines 1978).

This is the MPCI format, i.e. the way you go about administering the MPCI.

Place Figure 2 about here.

You show the child a certain phenomenon or some exemplar concerned with a concept that you wish to investigate his/her knowledge of. Then you ask a question (e.g. predict what's going to happen, explain what's happening and why, etc.). The child responds. Now the response is either relevant or irrelevant. If the response is relevant, you follow up with an additional question; and if the response is irrelevant, then you redirect them to the phenomenon or ask the question again in a different way.

Two important points should be made here. First of all, the interviewer needs to be an expert in his/her subject matter to differentiate the relevance of the child's responses. Only an expert can grasp subtle nuances which may be of extreme importance. Secondly, the interviewer must display an inordinate restraint and not bombard the child with

additional questions before s/he has had sufficient time to think about the first question. Mary Budd Rowe (1974) has very clearly shown the effects of wait-time on students' responses. Having the patience to wait for students to respond and to carefully listen to what they are saying is something that does not just come naturally, but is only acquired with much practice.* In short, for one to acquire interviewing skills, s/he must first be an expert in the content in concern with the interview and also must have a great amount of experience which results in interviewing skills.

The interviewer continues to probe the child's cognitive structure with follow-up questions until the whole content area under investigation has been exhausted to the interviewer's satisfaction. The interview situation is depicted in Figures 3 and 4. Notice that the child and the interviewer sit on the same side of the table so as to minimize confrontation and maximize communication.

Place Figures 3 and 4 about here.

A few examples used by this author to initiate interviews concerning "life" and "energy" are depicted in the following figures.

Place Figures 5, 6, and 7 about here.

You can use the battery tester or the motor in conjunction with one or more batteries to initiate interviews concerning the child's conception of "energy". The four pictures are components of a food chain used to initiate interviews concerning both "life" and "energy". Numerous other exemplars were used in the course of a single interview.

For more details concerning the administration of clinical interviews as described here, you can write to Professor George J. Posner in

the Department of Education at Cornell University and ask for the monograph by Pines et al (1978), which describes the MPCI. Also, video tapes have been made by this author in order to capture important aspects of the MPCI and its power as a research instrument. These tapes are now in the possession of Professor Joseph D. Novak in the Department of Education at Cornell University. These sources together with the previous sketchy outline of the MPCI must suffice at this time for purposes of explaining the relevance of interviewing to teaching and learning; and any additional details are clearly beyond the scope of this paper.

Interviewing Techniques as Teaching Tools

We now reach what I consider to be the upshot of this paper. Indeed by now, some of you may have already grasped the direction I have taken and thus the relevance of interviewing to teaching and learning, and to teaching theory and learning theory. Others may still be pondering the connection. What I have been trying to say is, to put it quite bluntly, that teachers ought to acquire interviewing skills as an important teaching tool because interviewing is the key to the interphase between theories of teaching and learning. Let me briefly elaborate.

A basic assumption in almost any theory of learning, most definitely in Ausubel's theory of learning, is that learning is highly dependent on what the learner already knows. Thus it follows that in order to provide relevant information, one must necessarily know something

about the learner's relevant existing cognitive structure. Thus the MPCI is relevant in that it enables one to find out aspects of the student's existing cognitive structure. Interviewing is a way of finding out which concepts have been acquired and to what extent these concepts are differentiated; it also enables the interviewer to probe for, and flush out, misconceptions. Pines (1977) has shown that prior knowledge has a profound influence on future learning and that misconceptions, if not adequately taken into account during instruction, can become more deeply engrained and inhibit future learning.

Furthermore, as teachers you probably know that teachers in most classrooms spend most of the time talking or telling. This is known as "the law of two thirds" because it is estimated that during approximately two thirds of the classroom time, the teacher is talking while less than one third of the time is spent on talking by all the students together. Ironically, this "law of two thirds" is one of the most stable in education. Providing teachers with interviewing skills can contribute to demolishing the "law of two thirds" in that teachers would enable their students to talk more and consequently, reveal what they know. Teachers must understand that the less they talk and the more students talk (not that the student will discover the subject matter themselves ; I'm not interested in that), the more efficient their instruction will be.

Moreover, the teacher's questions would not be rhetorical for the sake of asking but rather, they would be deep and penetrating. Consequently, the teacher would be able to capitalize on the students' most important resource, viz. their relevant existing cognitive structures,

and thus they would accomplish more in the less time left for them to talk. For example, once you know that a certain misconception exists or is prevalent, you can take steps in your instruction to ameliorate that misconception, replace it with an appropriate conception, and thus increase learning efficiency. This increase in the efficiency of learning is a *sine qua non* in today's world of "information explosion".

It would be absurd for me to ask teachers to sit down with each and every student and conduct an MPCI concerning each content area to be taught. I realize the time limitations! If no time constraints existed, I would, of course, recommend such practice. Within the time limitation the teacher can limit him/herself to interviewing the children having the most problems in learning. However, more importantly, in the classroom day to day, the teacher with interviewing techniques would be more efficient. S/he would know how to ask questions, listen to students' responses, and be able to restrain her/himself from telling in favor of teaching.

Summary

I must at this point, due to our time constraints, summarize. I will limit my summary to the three major points made in this paper.

1) "Teaching" and "learning" are two concepts that can and should be distinguished from one another. These concepts are not analogous to "selling" and "buying"; rather, "teaching" is an intentional verb whereas "learning" is a success verb.

2) A theory of learning is lexically prior to a theory of teaching. That is, one cannot effectively plan instruction without some prior notion of how people learn.

3) The MPCI is an important pragmatic way of acquiring teaching skills. This technique disciplines the teacher to ask relevant questions, listen to the students' responses which reveal what they know, and thus to talk less and teach more during the available time.

The conclusion of the paper then is that the MPCI techniques should be part of each educator's teacher training course. Acquiring the skills of interviewing would serve a purpose far more important than the myriads of trivia usually included in most methods courses.

* Piaget claims that two years are necessary to gain proficiency in interviewing. From this author's experience, an expert in a particular subject-matter domain can gain the necessary interviewing skills with one school year of intensive practice.

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Table 1. - Correlation Matrix

Correlation Matrix of a few selected scores collected in this study to measure individual differences.

1 Metropolitan: Total Battery	2 Preschool Inventory: Total Battery	3 Stanford Achievement: Total Battery	4 A-TESP• Achievement: Total Battery	5 Conservation: Matter	6 M. Space: B.D.S.	7 CEFT: Total Battery	
	r= 0.4243 p≤ 0.001 r²=0.18	0.8412 0.001 0.71	0.4499 0.001 0.20	0.2849 0.005 0.08	0.3637 0.001 0.13	0.3838 0.001 0.15	1
		0.5577 0.001 0.31	0.2684 0.003 0.07	0.2779 0.002 0.08	0.4824 0.001 0.23	0.2752 0.002 0.08	2
			0.6718 0.001 0.45	0.5514 0.001 0.30	0.6281 0.001 0.40	0.5718 0.001 0.33	3
				0.1954 0.023 0.04	0.3218 0.001 0.10	0.2564 0.004 0.07	4
					0.2817 0.002 0.08	0.3398 0.001 0.12	5
						0.2066 0.016 0.04	6
							7

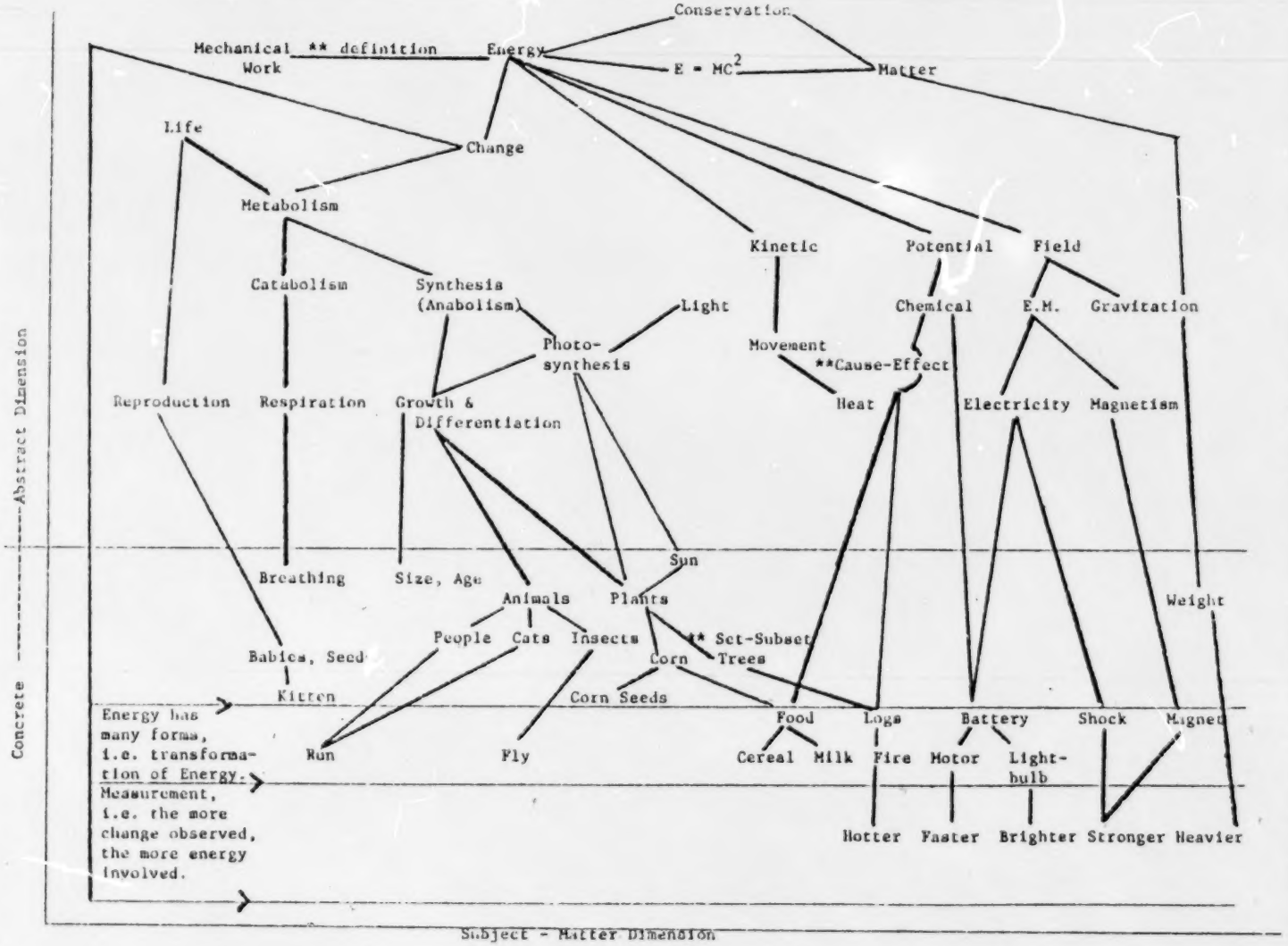
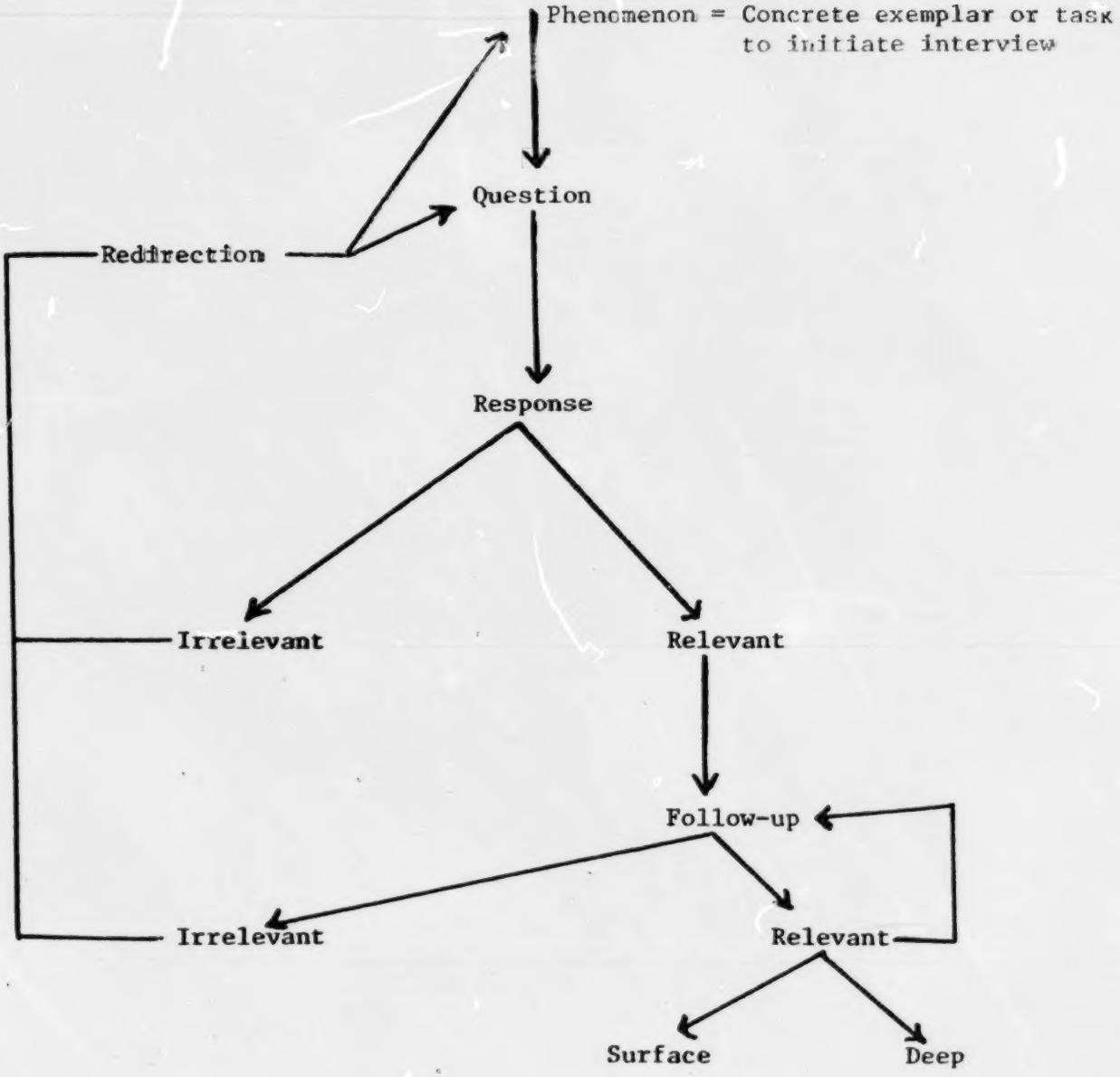


Figure 1. - A Concept Map



The Modified Piagetian Clinical Interview (MPCI) Format.

Figure 2.

Figure 3. - The Interview Situation.

Figure 4. - The Interview Situation.

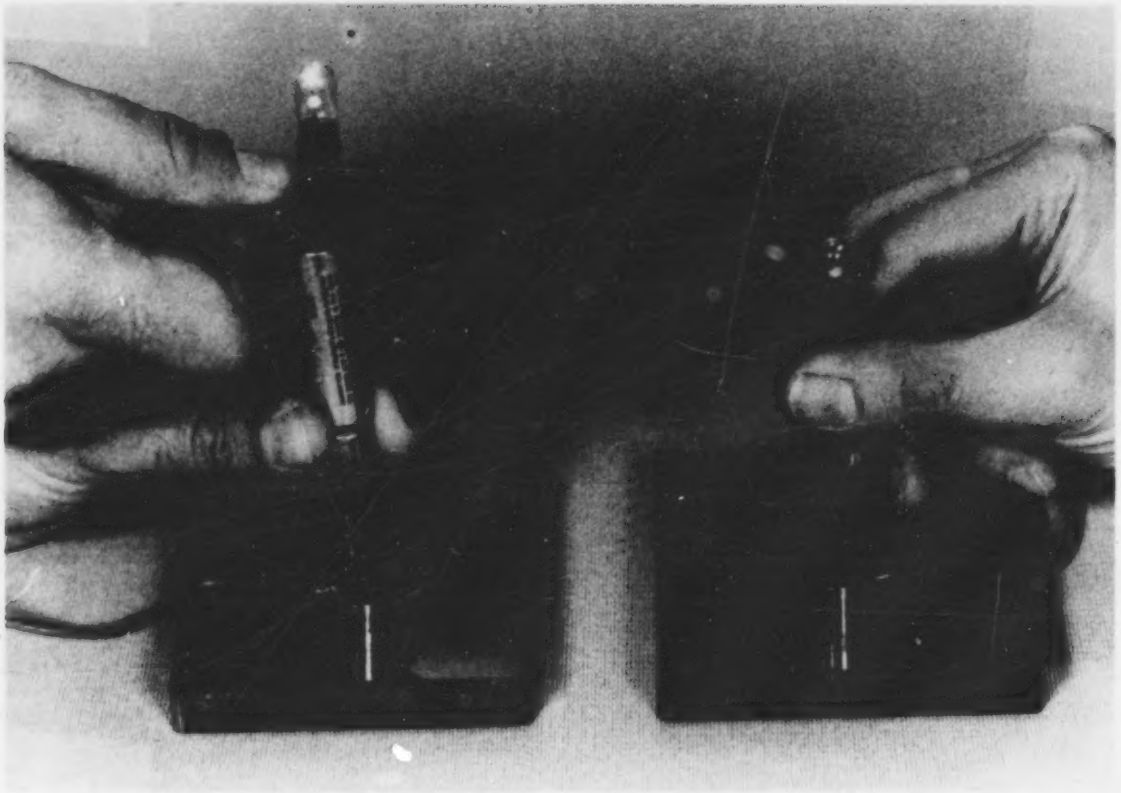


Figure 5. - Exemplar Used to Initiate Interviews.

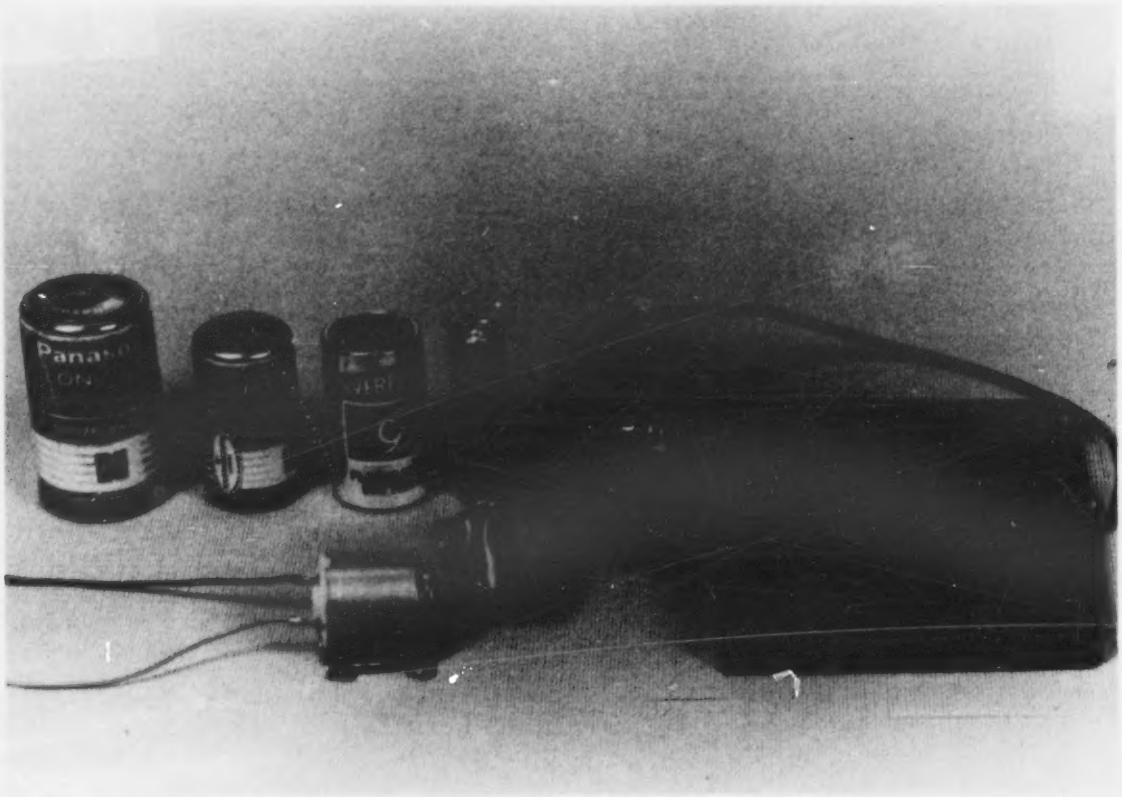


Figure 6. - Exemplar Used to Initiate Interviews

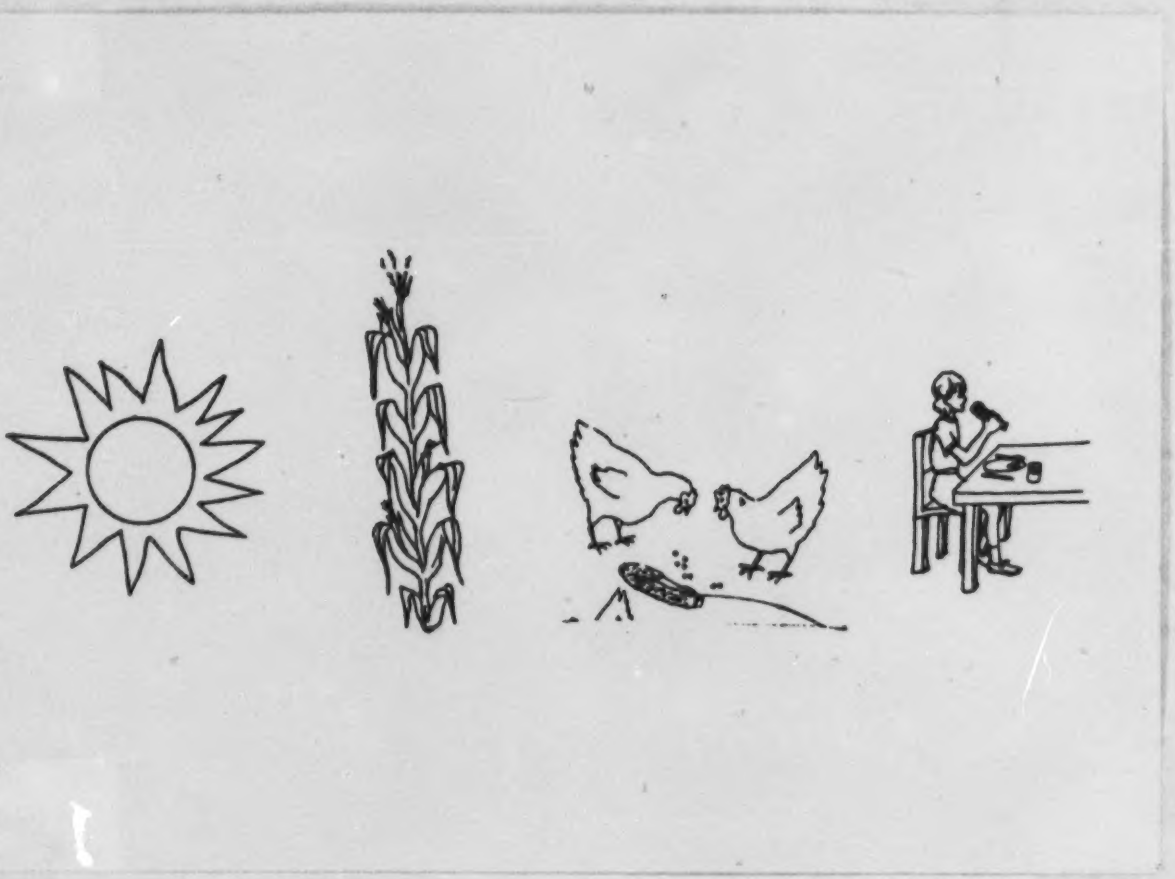


Figure 7. - Exemplar Used to Initiate Interviews.